



From Car-Oriented Development to a Bicycle-Friendly Environment. A Case Study in the Mugello Valley in Tuscany

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Abstract

In Italy, a distinct kind of settlement, resulting from the development of road infrastructure that since the 1950s has gone hand in hand with the country's economic growth, is represented by small urban centers located along the national motorway routes, which have experienced significant development in industry, logistics, and large-scale commercial distribution without becoming a city. An emblematic case is Barberino di Mugello, a center of medieval origin with a population of 10,000 at an exit of the A1 motorway between Florence and Bologna, which has developed into a sort of archipelago of segregated monofunctional 'islands' in a hilly landscape, linked and separated by road infrastructure. The paper focuses on a project commissioned by the municipality of Barberino di Mugello to a research group of the University of Florence, which aims to join the scattered urban islands by means of a bicycle network connected to an exchange car park at the motorway exit, conceived as the new 'urban gateway' of Barberino. The objective of the project is twofold: promote sustainable mobility as an alternative to the car for short trips, and provide an opportunity to raise awareness of the remarkable landscape resources of the area through the bicycle route.

Keywords

Bikeability · Urban planning · Landscape design · Active mobility

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1 Introduction

Italy has the highest motorization rate among the major European countries, equal to 67 privately owned vehicles per 100 inhabitants, i.e. roughly 19% more than the EU average (ACEA, 2022). The widespread use of motor vehicles and related infrastructures in the country is the result of a process that began in the late 1950s, along with an economic boom, largely based on the alliance of three key sectors: public investments on the one hand, and the oil and automotive industries on the other. While this development has led to a general improvement in the population's socio-economic conditions, which, despite numerous cyclical crises, basically held up until the structural crisis of 2007–2008, it has also had disruptive consequences on the settlement system, environment, and landscape, with which the country is now having to deal. As for the former, the most evident consequences were: (i) the concentration of businesses and the population in some parts of the country, and especially in cities connected to the motorway network in the northern and central regions, which over time have become generators of larger metropolitan areas, (ii) urban sprawl favored by car use in the in-between plain areas, and (iii) the progressive marginalization and depopulation of the less accessible centers in the inland rural and mountain areas. In the new geography designed by the national motorway system, revolving around both big and well-connected medium-sized cities, a distinct case, linked to the morphological features of the territories crossed and the spread of historical settlements throughout Italy, is that of small towns along motorway routes, which have experienced significant economic development without becoming cities.

An emblematic example is Barberino di Mugello (Fig. 1a, b), a center of medieval origin, with a population of 10,000, located along the A1 Motorway—the so-called 'Autostrada del Sole' (the 'Motorway of the Sun'), namely the backbone road infrastructure of the Italian peninsula,

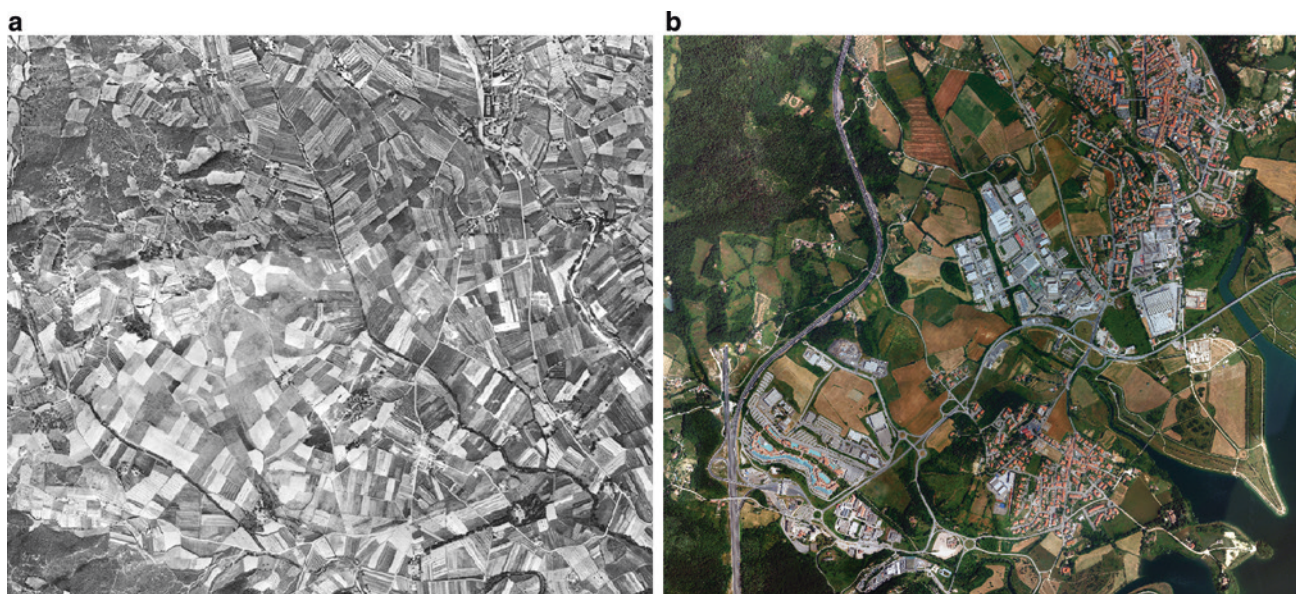


Fig. 1 a & b Aerial views of Barberino di Mugello in 1954 and 2019. *Source* Region Tuscany Geographic Information System

linking Milan to Naples—which has a dedicated exit halfway between two regional capitals: Florence in Tuscany and Bologna in Emilia Romagna.

Since the motorway opened in 1964, this small town has assumed a key role in the economy of the surrounding mountain region, the Mugello Valley (population 65,000), the northernmost part of the Metropolitan City—formerly Province—of Florence, tying its fate to the growth of motorization.

In 1974, ten years after the *Autostrada del Sole* opened, another major work dedicated to cars was inaugurated in the Mugello, already known since the dawn of motorsports for the road races held there. On the initiative of the National Automobile Club, one of the most important Italian racetracks was built in the municipality of San Piero a Sieve, adjacent to Barberino, and made accessible from the A1 Motorway by means of new road connections. Acquired in 1988 by Ferrari, the ‘Mugello Circuit’ regularly hosts international motor racing competitions (including Formula 1 since 2020) and is the official venue of the Italian Motorcycle Grand Prix.

In the last three decades of the 20th Century, the condition of being the gateway to the valley pushed the growth of Barberino di Mugello, reversing the depopulation trend which, similarly to other territories in the Apennines, had begun in the 1930s.

Over time, leading textile companies, large commercial distribution centers, activities related to the chemical industry, and small and medium manufacturers have established themselves in the available areas near the motorway exit and along the roads leading to the town center. Furthermore, a dense network of activities and services

for logistics has developed around the motorway junction, including restaurants and hotels for truck drivers, which have made Barberino di Mugello one of the most popular rest stops on the Milan-Naples route.

The result of this process is a widespread settlement gravitating to the motorway access rather than the town center, which resembles an archipelago of monofunctional islands, planned following zoning principles (Fig. 2). These are at the same time connected and separated from each other by the road infrastructures that cut through the valley.

At the turn of the new century, as the first signs of trouble were being felt by local businesses before the global financial meltdown in 2007–2008, Barberino di Mugello went through another phase of profound change related to the construction of two large facilities, which both benefited from their proximity to the motorway exit, becoming major traffic attractors of the Metropolitan City of Florence. The former is the artificial Lake of Bilancino, to the east of the town and completed in 1998. Designed as a dam reservoir on the Sieve River, a tributary of the Arno, to reduce the risk of flooding in Florence, the lake, with its surrounding green areas, beaches, and sports facilities, has quickly become a tourist attraction visited by thousands of people in the warm season, and especially on weekends. The latter is the Barberino Design Outlet, a renaissance-style fashion citadel that constitutes another monofunctional island in the aforementioned suburban archipelago. Opened in 2006, it now has more than 120 shops, restaurants, and cafés in an area of 27,000 square meters, attracting around 2.7 million visitors a year.

In the same period, the Apennine section of the A1 Motorway between Bologna and Florence underwent major

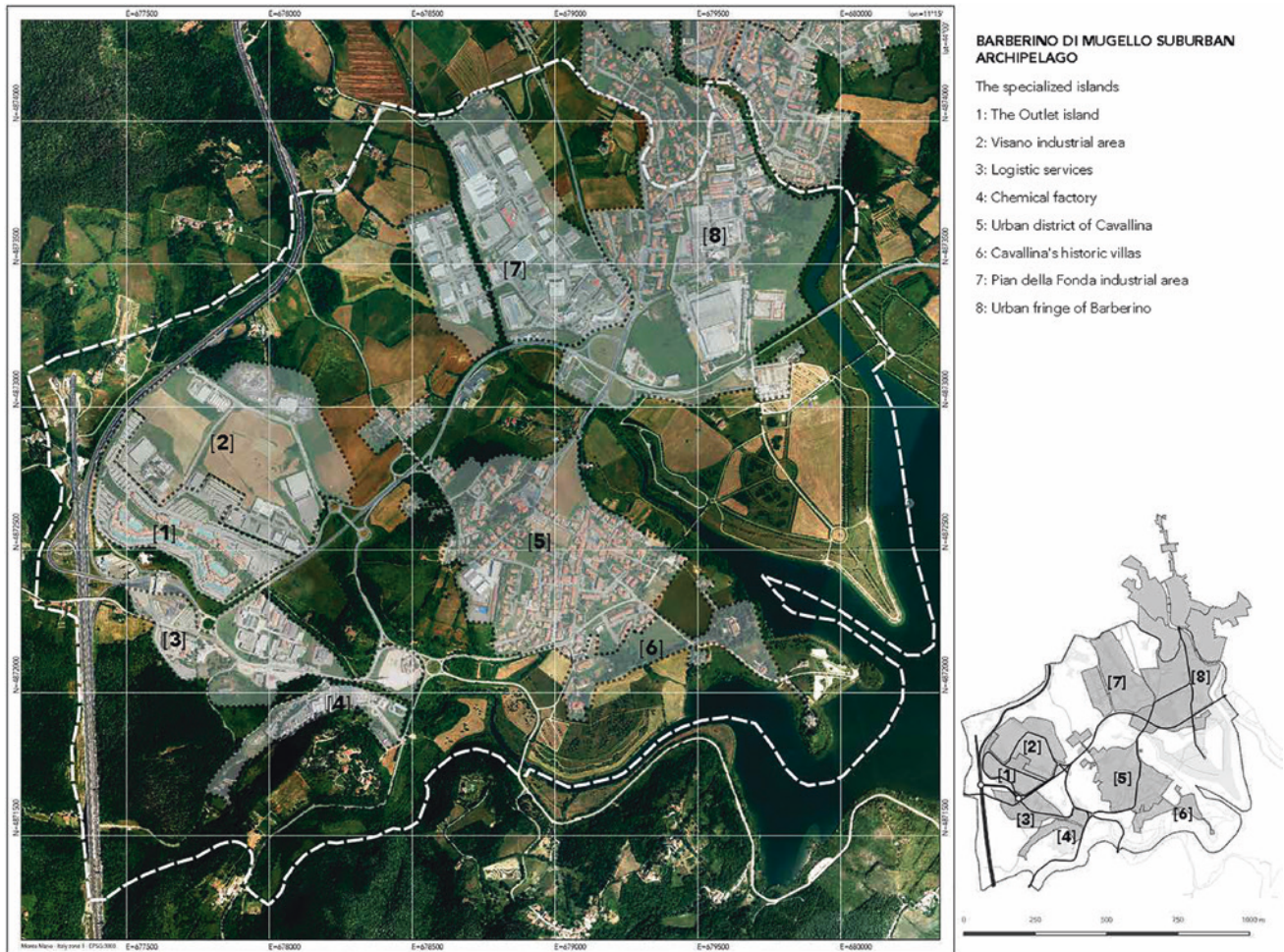


Fig. 2 Barberino di Mugello suburban archipelago

upgrading works, including the relocation and enlargement of up to 10 lanes of the tollbooth at the Barberino di Mugello exit, finally inaugurated in 2015.

In the face of the large visitor flows generated by the lake and the outlet, which produce congestion at the motorway junction without reaching the town center or entering the hinterland, the economic crisis saw the closure of many businesses which had established themselves on the outskirts of Barberino in past decades. The consequent decline of some islands within the suburban archipelago demonstrates the weaknesses of a development model based only on vehicular mobility, supported by an infrastructural network that fragments the territory and makes it almost inaccessible to pedestrians, bikers, and micro-mobility.

In fact, despite the short distances—the town center is less than 4 km from the motorway and all the amenities and attractions of the area are within a 2 km radius—getting around Barberino on foot or by bicycle is very difficult, except on dedicated paths in some specific areas—i.e. the pedestrian zone in the historic center, the pedestrian strip

inside the shopping outlet and the hiking and bicycle paths throughout Bilancino Lake Park. Instead, the bike lanes built in recent years along some streets following the Town Masterplan 2012 are still too few and discontinuous to offer an alternative to the car.

Against this backdrop, the need to renew Barberino's planning tools according to the principles of sustainability, land saving, and landscape conservation, underlying the Tuscany Region Planning Act 2014 and the Regional Landscape Plan 2015, allows us to envision a different urban development model from the one followed so far, leveraging the enhancement of local environmental resources, the recycling of urban derelict sites, and multimodal mobility. The study presented here, carried out by the SUP&R (Sustainable Urban Projects & Research) research unit of the Department of Architecture at the University of Florence as a scientific contribution to the new Town Masterplan ('Piano Operativo') being developed by the Municipality of Barberino di Mugello, addresses all these issues, while focusing in particular on the last one in

pursuit of a twofold objective: on the one hand, it proposes a new urban design for the entrance to Barberino from the A1 Motorway, that recognizes its role as an ‘urban gateway’ and encourages interchange between private cars, public transportation, and bicycles (including bike and e-bike sharing); on the other hand, it explores the feasibility of connecting the suburban islands to each other, with the Urban Gateway and Bilancino Lake Park using a safe and attractive soft mobility network separated from the road infrastructure, to be offered to locals and visitors as a competitive option for short-distance trips. Incidentally, the latter objective reflects a trend of Italian municipalities, including small and medium ones, to promote both daily bicycle mobility and cyclotourism. As reported by FIAB (Federazione Italiana Amici della Bicicletta, the Italian Union of Bikers’ Associations), this trend is growing (FIAB 2022), while recent analyses show that during the Covid-19 pandemic its acceleration was expedited (Annunziata et al., 2022; Barbarossa, 2020). Among the good practices of small bicycle-friendly towns listed by FIAB, one municipality in the contiguous region of Emilia Romagna shares common features with Barberino di Mugello and can be taken as a reference: namely Maranello (pop. 17,500), midway between two exits of the A1 Motorway and with many ties to the automobile world, being the home of Ferrari’s headquarters, its museum and test track.

2 Scientific Background and Methodology of the Study

There is a general consensus that walking and cycling are two essential components of making urban mobility sustainable, which is reflected in a large body of scientific literature (see, *inter alia*: Banister, 2008, Pucher & Buehler, 2010, Moura & Kalakou, 2021), in the decarbonization and green transition strategies of many European cities, as well as in EU directives and funding lines in the fields of transport and urban sustainability. This assumption is supported by the consideration that a high rate of daily travel in urban areas is short-distance. In fact, the World Health Organization estimates that 50 percent of daily trips in European cities would not exceed an average of 5 km: a threshold very close to the 4.5 km distance, up to which, according to Whitelegg (1993), cycling on safe and uninterrupted paths is faster than driving.

In urbanized contexts that have been shaped by the automobile, as in the case of Barberino di Mugello, the issue of creating a friendly environment for pedestrians, bikers, and micro-mobility users, either by implementing a new infrastructure or adapting the existing one, is strictly related to the adoption of suitable design approaches.

Unlike road infrastructure, which is basically defined by the characteristics and performance of motor vehicles, the design of well-functioning active mobility facilities needs to be human-centered and place-based, as people moving on foot or by bicycle employ logic, feelings, and attitudes that are profoundly different from those of motorists.

The great distance between engineering design methods and more sensitive approaches to the design of bicycle paths – explicitly highlighted, among explicitly highlighted, among others, by Hamilton-Baillie (2004)—emerges clearly from the contributions of several authors, stressing the importance of considering qualitative criteria to enrich and correct the quantitative approach to the design and evaluation of active mobility infrastructure (Van Duppen and Spierings 2013, Reggiani et al., 2022), including the users’ point of view (Pesshanna et al., 2020).

Such contributions often refer to the concept of ‘bikeability’: although this concept does not have a universally accepted definition (Kellstedt et al., 2021) it keeps both objective and subjective factors together (Arellana et al. 2020) and in doing so it integrates individual and collective perception to capture and deliver in the project dynamic interaction between places, infrastructure, and users.

Along these lines, the approach applied to the Barberino case study combines design criteria related to the structural features of the cycle-pedestrian network (e.g., continuity, connectivity, and completeness of the network; number and characteristics of the connected nodes including access, modal interchange, and attraction points, etc.) with criteria concerning safety, comfort, the quality of the places passed through and of the time spent on the move. These last two aspects are particularly significant when pursuing the aim of making active mobility a competitive option to the car.

As far as the quality of the places is concerned, passing through a familiar, safe, and pleasant location or along an unusual path that stimulates curiosity and discovery; the opportunity to cross many different places along a route or to get a better view of the surroundings; the chance to encounter people or to be in less-crowded places; the structural characteristics of the path that make it easier to travel by vehicle or more suitable for one’s physical condition: these are all variables that affect both travel choices and the perceptions of those who move around.

No less important is the quality of travel time. Similarly to space, subjective aspects affect the way people enjoy or do not enjoy the time. Therefore, contrary to the assumption that informs the conventional Value of Travel Time (VTT) analysis in transport appraisal methods, developed in the 1960s to accommodate the growth of automobile traffic in industrialized countries, travel time is not necessarily a disutility but can instead be worthwhile depending on the subjective experience gained from different transportation

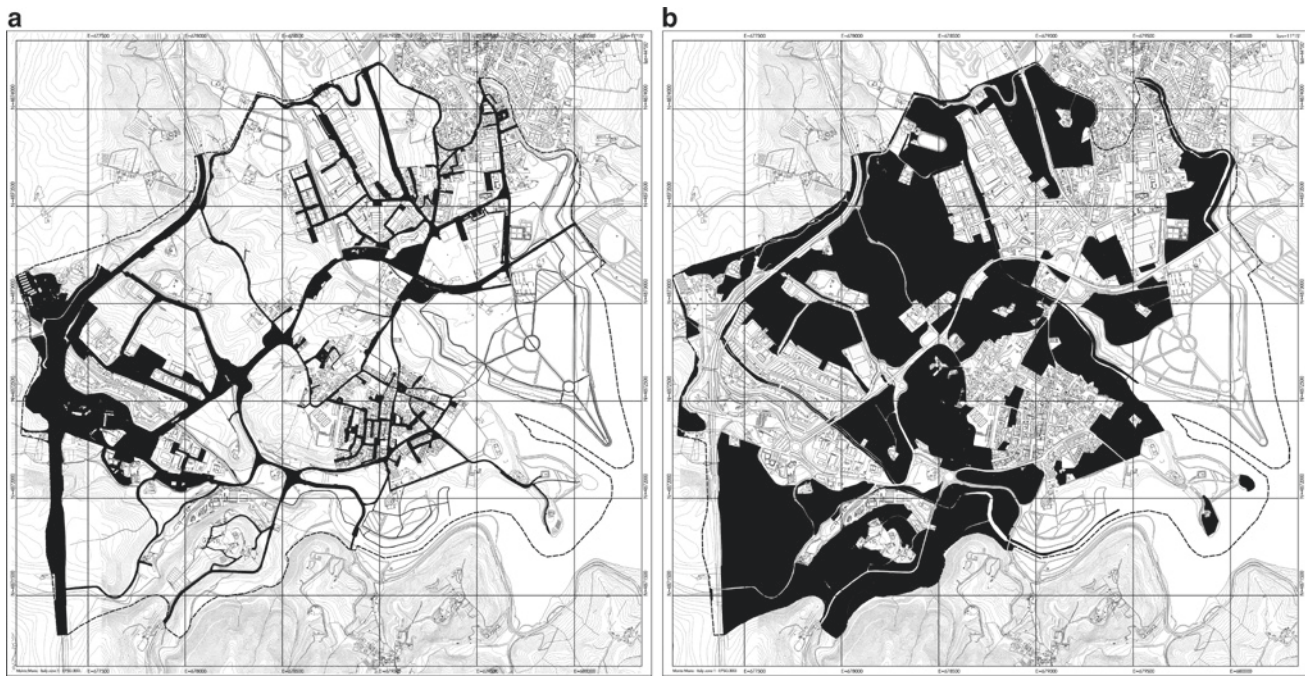


Fig. 3 a Road connections. b In-between open spaces

options (Cornet et al., 2020). It follows from this premise that the shortest way is not always the favorite. The possibility of obtaining physical and mental well-being from the act of movement itself can make active modes preferable to driving, on the same or a different route, due to the better quality of time experienced when the need to move is combined with action on one's well-being.

In addition to the selection of scholarly contributions on the topic of bikeability, from which the basic concepts and methodological inputs for the work have been derived, since the first stages of the study a specific bibliographic survey has been geared towards the collection of international case studies, to immediately orient the investigations towards the possible replication of project solutions already tested in similar situations. Given the characteristics of Barberino di Mugello, the analyzed case studies have covered urban and suburban cycle-pedestrian connections, tourist bike routes in rural landscapes, as well as devices to overcome natural and infrastructural barriers in both kinds of contexts.

At the same time, desk analyses on Barberino, carried out with the support of the Municipality's technical offices, were implemented along with field surveys. Together they led to the aforementioned interpretations of the access area from the A1 Motorway as the Urban Gateway to Barberino and the Mugello Valley and of the surrounding territory as a suburban archipelago. Consequently, they led to the recognition and mapping of eight specialized islands, as well

as the characterization of the in-between areas that constitute the potential space of relationships, within which new routes of active mobility through the archipelago could be designed.

The methodology applied to the desk analyses (Figs. 3a, b and 4a, b) responds to the need to acquire and organize a complex set of data. A geo-referenced database has been set up to archive and relate information layers of various kinds, both quantitative and qualitative, partly acquired from the cognitive framework of the Town Masterplan under development.

3 Discussion

The overlapping of the information layers collected from desk analyses revealed within the study area the widespread presence of different types of spaces, classified as 'spaces of opportunity', to be leveraged when formulating the design strategy. They include both territorial heritage elements (Magnaghi, 1998; Poli, 2018) that need to be enhanced and reconnected, as well as discarded urban spaces that can be usefully recycled. Among the former, strategic importance is placed on the blue-green corridor of the Sieve River and the Bilancino Lake Park, already the subject of a previous study to improve its landscape and enhance cultural tourism, developed on behalf of the Municipality by the Landscape Design Lab—in turn,

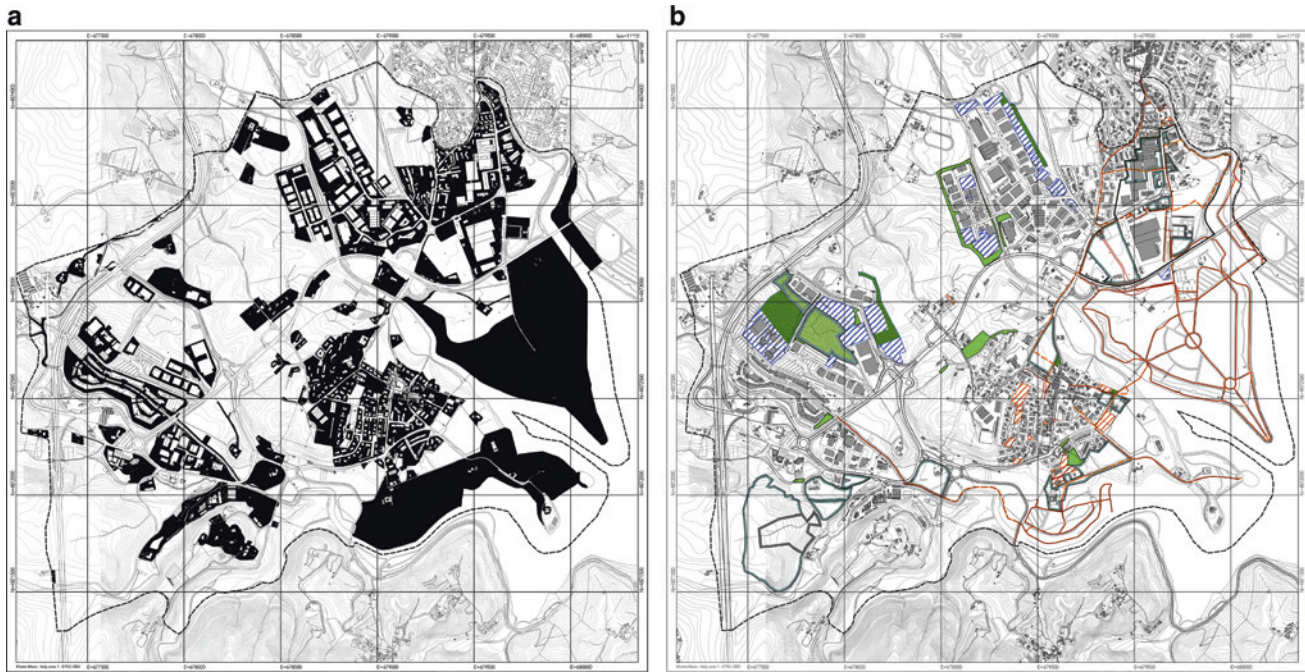


Fig. 4 a Specialized island (incl. Bilancino Lake Park). b Spaces of Opportunity

a research group of the Department of Architecture of Florence. It was immediately decided to integrate the cycle-pedestrian paths, introduced in that study as structuring elements of the landscape recomposition, into the broader active mobility system discussed herein. In this way, the park's isolation from the center of Barberino is overcome by reconciling it with the unifying idea of the suburban archipelago, made up of islands interconnected by multi-modal transportation networks.

The discarded spaces assumed to be spaces of opportunity include residual areas, brownfield and greyfield sites, and pieces of the urban mosaic where past land-use choices have never been implemented: that is the full range of stand-by spaces, whose development or redevelopment—following the rules of the forthcoming Town Masterplan—could contribute to the new layout of the Urban Gateway as well as the creation of the active mobility network.

The geographic information on the spaces of opportunity, public areas (i.e., public space, parking lots, and open spaces in public properties and facilities), and the already existing stretches of bike paths have been checked and completed through on-site inspections, thus providing material for a project proposal tailored to the context.

The approach adopted in the project proposal delivered by the study aims to identify highly effective interventions calibrated to both financing aspects and their proactive action and ability to make the most of existing opportunities. This does not exclude a priori engineering

interventions of some significance (which are unavoidable, for example, to cross the roads at the motorway junction), but prioritizes systemic interventions with relatively low costs and short- to-medium construction times, which can also be implemented in sequential steps so that each component of the system can be used immediately.

In summary, the project pursues the following specific goals:

- The creation of a legible and widely accessible active mobility system to connect the urbanized islands and the main public spaces and facilities within the suburban archipelago, by reconnecting, wherever possible, existing stretches (including the bicycle routes along the Sieve River and crossing the Lake Park) and reusing or adapting farm paths, embankment paths, road underpasses, and other already present physical links and lines.
- The morphological and functional reorganization of the area at the entrance to Barberino di Mugello from the A1 Motorway (Urban Gateway), rearranging residual and abandoned spaces, including the old decommissioned tollbooth area, in the design of an intermodal hub; this is conceived as a 'dock' and sorting point for vehicular flows arriving from the motorway, an interchange between cars, public transport, and shared mobility services, and as the main point of access to the active mobility system.
- The identification inside each island of parking lots that are easily accessible from the main road system, to be

reorganized and refurbished as ‘second-level docks’ in turn connected to the active mobility routes.

- The landscape improvement of the road infrastructures concerned and related roadside strips.
- The landscape enhancement of the in-between open spaces of the suburban archipelago, crossed by the active mobility routes.
- The reuse of abandoned and underutilized spaces improves the landscape and creates new public space within the urbanized islands.

Moreover, the new arrangement of the Urban Gateway seeks to solve some current problems of the entrance to Barberino from the motorway—first of all, road safety. In the proposed solution, car parking is separated from the rest area set up for trucks, which is accessed by an almost entirely dedicated roadway, thus greatly reducing intermixing between heavy goods vehicles and light vehicles. In addition, the inclusion of rich tree vegetation along the roads and within the parking lots not only enhances the urban landscape but also aims to mitigate the urban heat island effect, which usually affects large asphalt surfaces, as well as to reduce noise and improve air quality in that traffic-intensive place (Fig. 5a, b).

The possibility of interchange with public and shared transport, as well as of leaving the car to continue to the lake or any other destination by bicycle, is provided by a wide pedestrian platform connected to the active mobility system by a semicircular path, outside the existing large traffic circle, which is maintained. The path has two underpasses that allow its total separation from vehicular flows and overcome the existing height differences due to both the terrain and road infrastructure embankments. Thanks to its recognizable shape, wide cross-section (3 m), red pavement, and crown of street lights arranged along

the circumference, this device becomes a highly communicative landmark in terms of visual ergonomics and wayfinding.

Bicycle and pedestrian paths, which can also be used by light electric vehicles, wheelchairs, and mobility scooters, branch off from here to form a ring totaling 10 km, 80 percent of which consists of readapted existing stretches of path. A number of secondary routes are also identified in the project to be used as cross-connections. The Active Mobility Ring (Fig. 6) is divided into 15 sections (including the connection with the Urban Gateway), for each of which a technical sheet has been prepared. All sections of the Ring have the same 3-m width but have different surface finishes depending on the characteristics of the crossed areas: concrete conglomerate in urban areas, stabilized earth in rural ones and within the Bilancino Lake Park. Thanks to the Active Mobility Ring, it will finally be possible for a person living in the center of Barberino to go to the lake or outlet, or to reach the industrial areas and shopping facilities on the outskirts of the town by bicycle; while tourists will be offered the opportunity, for example, to combine a tour of the lake, which is part of the bicycle touring routes through the Mugello Valley, with a visit to the medieval center of Barberino, which had been cut off until now.

4 Conclusions

For over 60 years the territory under study has been affected by disruptive changes resulting from choices made at the national level (the construction of the Autostrada del Sole and its recent upgrades and the construction of the Mugello international racetrack in its immediate vicinity), at regional level (Bilancino dam and lake) or dictated by exogenous economic interests (the fashion outlet). These

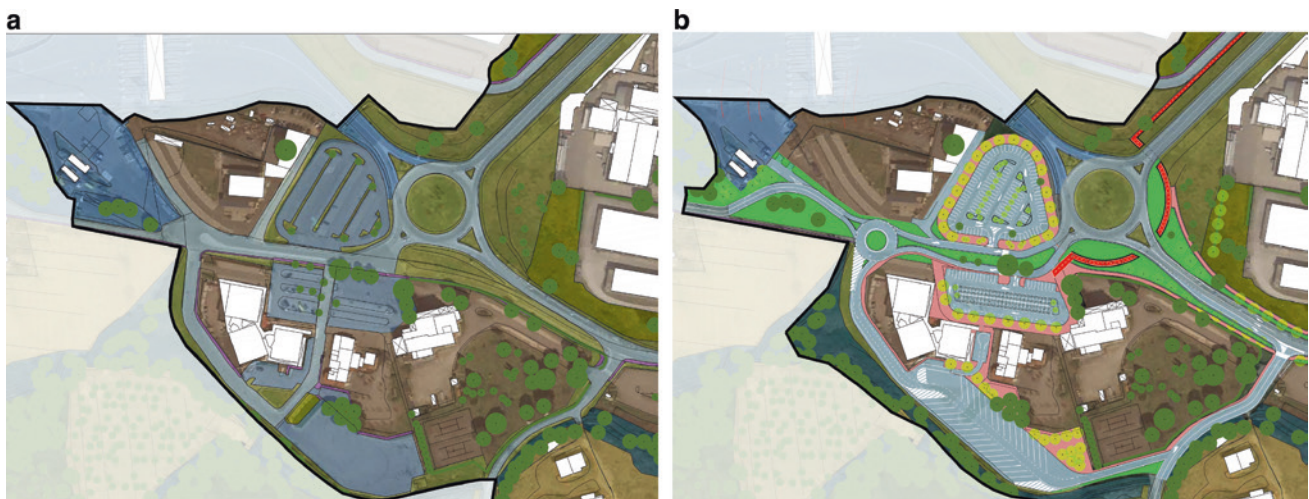


Fig. 5 a, b The Urban Gateway area: state of the art and project proposal

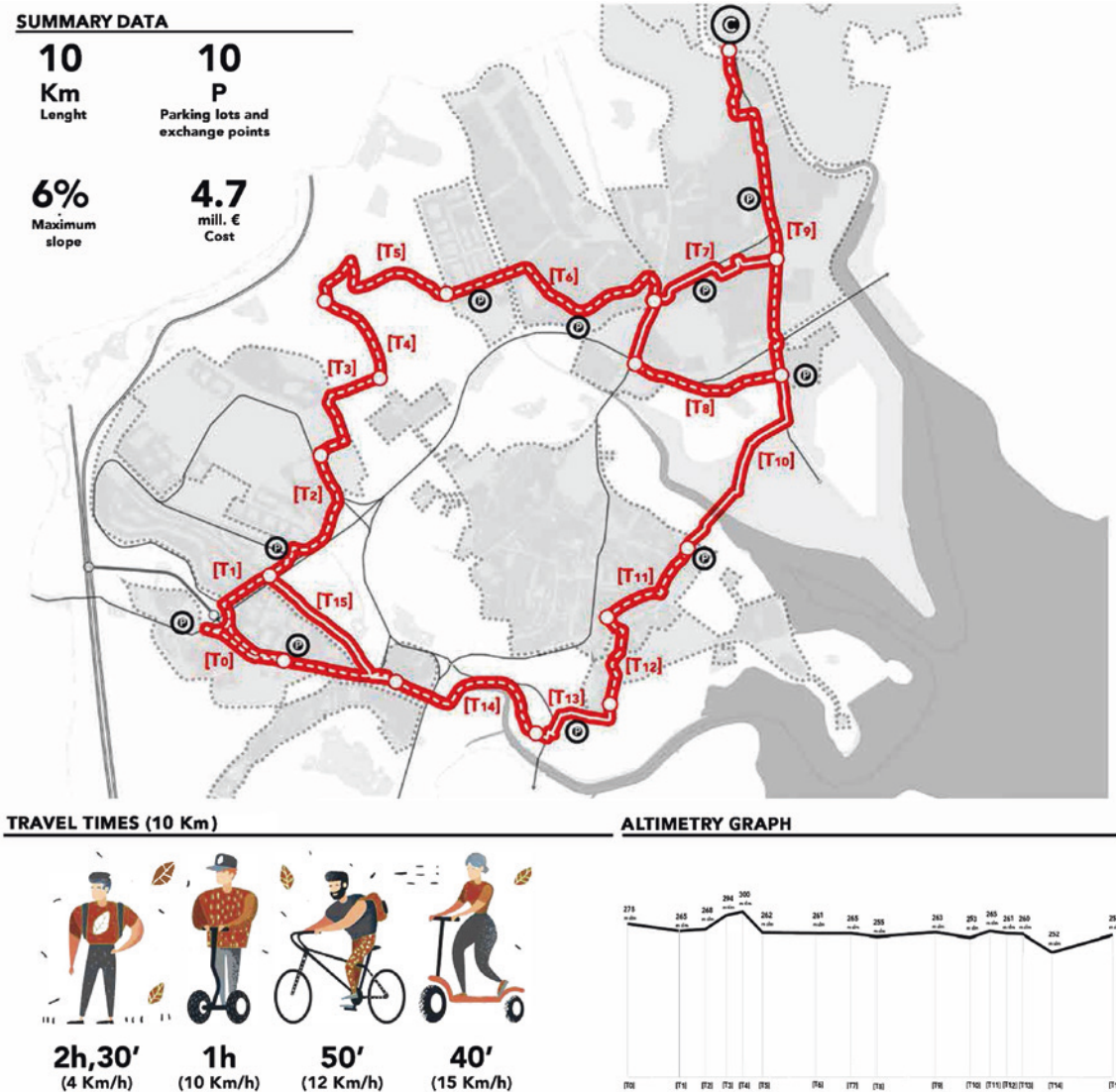


Fig. 6 The Active Mobility Ring of Barberino di Mugello

transformations have triggered fluctuating economic processes, similar to those of larger urban centers, which on the one hand have prevented the depopulation of Barberino and its valley, but on the other hand, have not raised Barberino to the rank of city. Suffice it to say that, while the urbanized area has more than quadrupled, the current population of the municipality is roughly the same as it was in 1901 and almost 1,000 less than in 1921, when, in a still exclusively rural context, it reached its demographic peak.

However, the territory’s land-use patterns and legibility have changed substantially, both because of the fragmentation of the industrial and commercial settlements that sprung up randomly with no continuity with the main urban center and because of the road infrastructure, which due to geometric rules completely unrelated to the land creates physical barriers, visual barriers, and artificial height

differences, making orientation extremely difficult. As Appleyard, Lynch, and Myer observed in their *The view from the road*, such a sense of bewilderment induced by self-referentially planned infrastructure is at the same time a failure on the part of the road engineer and a frustration for motorists: “When not aware of general location with respect to the landscape, a driver is likely to make mistakes and is sure to be under stress.” (Appleyard et al., 1964: 16).

With a totally different approach from that underlying the great road system, but at the same time offering a complementary mobility option, the intervention presented herein proposes—to use Lynchian vocabulary again, from *The Image of the City* Lynch (1960)—connoting the motorway access to Barberino as a ‘landmark’, making the suburban ‘districts’ recognizable as islands in an archipelago, identifying for each of them ‘nodes’ (what we have called

‘docks’) and connecting ‘paths’ with the other districts, and elevating travel time through the experience of the surrounding landscape. In this sense, it can be read according to the concept of ‘appaesamento’ (assimilation), introduced by the Italian anthropologist Ernesto De Martino (1951) and absorbed by other disciplines, including land sciences (Guarducci & Rombai, 2017), as opposed to ‘spaesamento’ (bewilderment): a dialectic that is widely reflected in the international debate on the issues of the identity and recognizability of landscapes (Antrop, 2005; Roger, 1995). It is the cognitive and cultural process through which an environment becomes familiar, through instinctive recognition and assimilation of its rules and codes, to those who are part of it or come into contact with it. The Active Mobility Ring is in fact an infrastructure, a communication device, that provides multiple access keys to the served territory:

- it implements and expands territorial accessibility in a widespread manner;
- it facilitates and promotes travel on foot or by sustainable individual transport modes;
- it expands the itineraries through which to discover and enjoy the landscape;
- it improves the quality of the open spaces crossed, both in urban and peri-urban areas, as well as throughout the country.

Given the hybrid character of the area concerned, which mixes elements of the urban periphery with high-value environmental areas, and the diverse nature of its points of interest, the usual differentiation between urban cycle-pedestrian infrastructure and tourist bicycle routes is overcome here by the provision of a catalog of recurring technical solutions, which can be combined in different ways depending on the contexts tackled.

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